

AUTHOR'S REPLY BY TERUMI TOUHEI

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Firstly, I would like to thank Professor Kausel for his interest in my paper. As pointed out by Kausel, there are innumerable works devoted to the formulation and application of TLM. Among them, methods for calculating the transient response of an elastic layered medium have been presented by Kausel¹ and the author.^{2–7}

In the papers,^{2–4} the author presented the time domain TLM, in which a method for obtaining the transient response of an elastic layered medium is similar to that presented by Kausel.¹ The author also discussed the propagation of the Love waves and the Rayleigh waves, and showed that the transient Rayleigh waves were obtained from the eigenvalue problem of the Hermite matrix whose eigenvalues are real but eigenvectors are complex.

In the present paper,⁶ I intended to propose that the transient elastic wave field represented in terms of TLM implied a spectral decomposition of the transient wave field into normal modes in the time-space domain. According to the spectral theory,⁸ a completely continuous symmetric kernel such as Green's function defined in a finite space can be expressed by,

$$G(x, y) = \sum_i \frac{1}{\mu_i} \varphi_i(x) \overline{\varphi_i(y)} \quad (1)$$

where $\varphi_i(x)$ denotes the orthonormal sequence of characteristic functions such as normal modes, μ_i the sequence of corresponding characteristic values and $\overline{\varphi_i(y)}$ the complex conjugate of $\varphi_i(y)$. Green's function in the time domain represented by TLM or the normal mode superposition method has similarity to equation (1). In this sense, investigating the propagation of normal modes in the time-space domain is to examine the spectral components of the transient elastic wave field. I examined the transient propagation of the negative group velocity waves by means of this concept. It is true that Lysmer⁹ found that some normal modes exhibited negative group velocity as Kausel suggested. However, Lysmer did not examine the transient propagation of negative group velocity waves at that stage.

In Reference 5, I presented a method for synthesizing the complete response of an elastic layered half-space due to a seismic point source by using the time domain TLM. I showed that Green's function in the time domain of an elastic layered half-space could also be expressed in the form of equation (1), if the causality arguments were used to define the time window in which Green's function is valid.

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